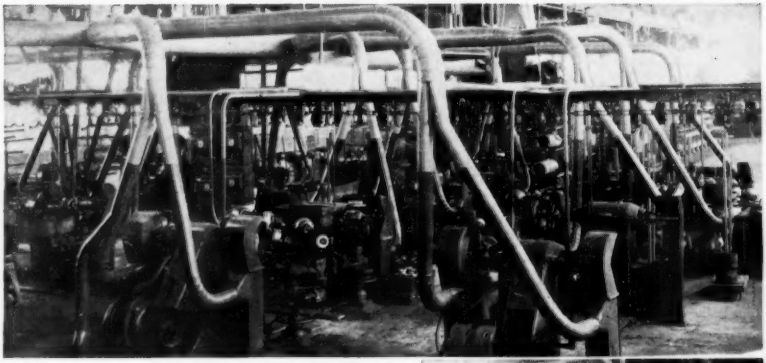
Occupational HAZARDS

DECEMBER 1939

To you, whose efforts in the control of occupational hazards have made Christmas joy possible for millions of workers and their families, we wish a Merry Christmas!

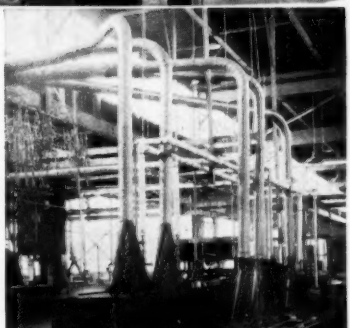
Christmas—sing merrilie

There's Profit in Prevention



KIRK & BLUM SYSTEMS

"Clear the Air" at Canadian Motor Lamp Company . . . . . .



The Kirk & Blum Dust Control Systems shown above serves the polishing and buffing departments at the Canadian Motor Lamp Company's Windsor plant. Two fans discharge the air into a centrifugal-type collector for removal of heavier dust, lint and tripoli, then through a cloth screen dust arrested for removal of remaining light dust. Acid fumes and vapors are removed from the plating department by the K & B System illustrated at the right.

Thus—here, as in plants of many industrial leaders throughout the nation, Kirk & Blum Systems help to protect men and machines, improve working conditions and morale, increase production, insure a better product, cut maintenance costs, save on insurance rates.

The services of Kirk & Blum Engineers are available to solve your dust control and fume removal problems. Details and interesting, illustrated books mailed on request. Write today—no obligation.

THE KIRK & BLUM MFG. CO. · 2802 Spring Grove Ave., Cincinnati, Ohio

Chicago Representative: C. P. Guion, 1661 N. Milwaukee · Pittsburgh: The Bushnell Mchy. Co., 311 Ross Street

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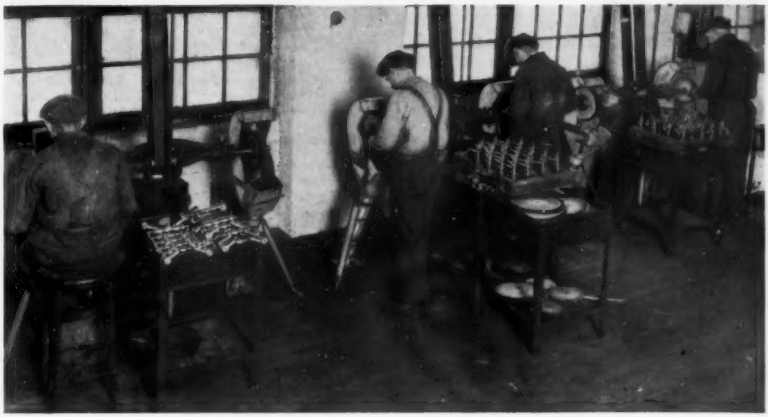
KIRK & BLUM

DUST AND FUME CONTROL

ENGINEERS AND CONTRACTORS

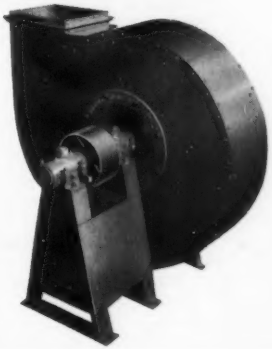
Men SAFELY at Work!



BECAUSE the dust from every grinding and polishing wheel is immediately and efficiently exhausted by the powerful suction of Buffalo Exhausters.

The air is kept free from harmful abrasive dust. Better health is maintained, and better production schedules are the result.

Whatever the material to be exhausted, there is a rugged Buffalo Exhauster to do the work better. For complete details, write for Bulletin 410-F.



BUFFALO FORGE COMPANY
191 Mortimer St., Buffalo, N.Y.
Branch Engineering Offices in Principal Cities
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo" POWER BLOWERS and EXHAUSTERS

The publications briefly described in this service department are prepared by manufacturers' technical experts. The data they contain on equipment supplies and prevention methods applies to varied phases of occupational hazard problems. Note those items desired on coupon below and send to Occupational Hazards, 812 Huron Rd., Cleveland, Ohio.

210—NEW TREATMENT FOR BURNS
Foile, a new substance for treatment of burns, is completely described, together with case histories and photographs of severe cases, in a booklet issued by the Mine Safety Appliances Company who are distributing Foile.

211—HANDLING OF HAZARDOUS LIQUIDS
A complete line of Protectoseal safety cans, operating cans, and drum fittings is described in the book just published by the manufacturer. These devices are approved by certain insurance underwriters, and are intended for a variety of situations where hazardous liquids must be used.

212—GOGGLES AND LENSES
Bausch and Lomb have just issued a very interesting discussion of eye-protection equipment. The book, which is beautifully printed, also includes illustrations and specifications of various of their goggles and lenses.

213—DERMATITIS
A short discussion of dermatitis and the hygienic measures in prevention is included in the booklet discussing LaGrace soaps and dispensers.

214—FOOT PROTECTION
A brochure illustrated in full color describes and gives specifications for the many varieties of safety shoes manufactured by the Craddock-Terry Shoe Corp. This information is of such specific nature that it is valuable in evaluating the individual feature of each type of shoe.

215—HAND CLEANER
"Lan-O-Kleen," a new hand cleaner made from a base of corn meal impregnated with lanolin, is described in a folder issued by the West Disinfectant Company.

216—SPARK ARRESTERS
Specifications and descriptions are contained in a bulletin on exhaust spark arresters issued by Air-Maze Corporation.

217—DRUM OPENER
A folder describing a new safety drum opener has just been issued by Merrill Brothers. The device is particularly adapted to safe handling of hazardous liquids.

218—HAND WASHER
A new type of hand washing fountain called "Showerway" has just been put on the market by Lyon Metal Products. The hygienic aspects of clean hands, particularly in relation to dermatitis, is outlined in the booklet now available.

219—"THE WASHROOM"
A monthly publication named "The Washroom" made its appearance this month. Sugar Beet Products Company, publishers of the little paper, announce that it will be issued monthly, and will be devoted to proper washroom installation, operation, and maintenance.

FREE LITERATURE COUPON Clip out and paste on postcard or enclose in envelope.
Mail to: OCCUPATIONAL HAZARDS, 812 Huron Road, Cleveland, Ohio.

Nos. of desired items .....

Firm Name .....

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FL-15

THINGS we never knew until now: the "hurricane" in the motion pictures of that name (and if you saw it, you'll remember that it was *some* blow) came from none other than one of our manufacturers of industrial ventilating equipment—Buffalo Forge. We're not sure whether they considered that hurricane in the nature of an occupational hazard, or as air conditioning. Anyway—we call it hazardous, don't you—Miss Lamour?

BUT, to come back to real hazards, the American Foundrymen's Association committee on Industrial Hygiene Codes has issued the fourth of its series of recommended good practices codes. The title of the new work is "Recommended Good Practice Code for Metal Cleaning Sanitation." It covers good practice in installation and operation of alkaline, solvent, solvent degreasing, metal pickling, tumbling mill and abrasive blasting cleaning operations; as well as general information on control of hazardous exposures in metal cleaning. Much of this information is of great interest in both old and new installations, and is just as valuable in planning new operations as it is properly operating already existing ones. The Committee is due congratulations for this monumental two-year work.

WE DOUBT that handling of dry ice is very wide spread, but information comes to us about several recent cases of disability as a result of improper handling. We're inspired to shoot a few facts at you on the subject, so, if you do handle dry ice, do it right. Dry ice is so cold that it raises a blister on the skin when touched for any appreciable length of time. It should not be handled with bare hands. These blisters are much the same as burns, and can be disabling. Further, since the "ice" is constantly passing from a solid to a gaseous state, it will explode if kept in an air tight container. A container that will withstand a pressure of about 1,000 pounds per square inch is safe enough, but beware anything less strong. Safe practice is not to permit it to be sealed in a closed container.

THE FACTUAL ARTICLE by Mr. Andrew Fletcher of the St. Joseph Lead Company which appears in this issue is another case where the value of controlling hazards is proven in dollars and cents. While the primary problem with St. Joseph Lead was the prevention of occupational disease among their workers, preventive measures installed actually showed a profit to the Company.

MR. FLETCHER is Vice-Chairman of the Board of Trustees of the Air Hygiene Foundation in Pittsburgh, before whose annual meeting the St. Joseph story was presented. As you probably know, the Air Hygiene Foundation is an association of men and companies interested in studying and controlling air conditions as a means of preventing occupational diseases among workmen. The Association collects and evaluates industrial health information and serves as a clearing house for such information. The Foundation works with its member companies, making plant surveys, providing counsel of the Foundation's various consulting specialists. Research is sustained by the Foundation at The Saranac Laboratory, Harvard School of Public Health.

(Continued on page 32)

A new and practical way to bandage now used in thousands of plants. It is Gauztex. Cohesive. Use instead of gauze or adhesive tape. Easy to use. Men like it. Keep them on the job. Write for free samples, literature, and prices. General Bandages, Inc., 508 S. Dearborn Street, Chicago, Illinois.

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GAUZTEX
THE SELF ADHERING GAUZE

TYPE C-1

Patents Pending

Send for folder describing this and fourteen other types.

JACKSON Eyeshields

Used at many hazard points throughout industry, this light, well ventilated shield is positively non-fogging and easily adjusted at any angle. Cellulose Acetate visor with full metal binding provides excellent vision without distortion. Sparks do not effect it nor will hot metal particles stick to it. Visor guard and comfortably lined head guard made of non-inflammable fibre deflect sparks and give added protection against industrial hazards. Available in clear, smoked, light green or amber. Visor depth 4"—other depths to 9" at small additional cost.
If your dealer can't supply you, please write to us.

JACKSON ELECTRODE HOLDER CO.
15122 Mack Ave. Dept O-1 Detroit, Mich.

Protectors In Standard Safety Code

This is the eighth in the series of recommended protectors as set forth in the revised copy of "The American Standard Code for the Protection of Head, Eyes and Respiratory Organs."

Hose Mask

Body Harness—The harness shall be made of leather, fabric webbing, or equivalent material. Material, joints, and seams of shoulder straps shall separately withstand a pull of 250 lb. (113 kg.) without failure. Belts, rings, and attachments for life lines shall withstand a pull of 300 lbs. (136 kg.) without failure. The hose shall be firmly attached to the harness so as to withstand a pull of 250 lb. without separating, and the hose attachments shall be arranged so that the pull or drag of the hose behind an advancing wearer does not disarrange the harness or exert pull upon the facepiece. Harness shall be adjustable to various sizes.

Supply Hose—If no blower is used, the inlet to the hose shall have a terminal fitting or chamber which provides for drawing the air through 200-mesh high-chrome-nickel wire screen (stainless steel) with an adjustable leather or webbing strap at least 18 in. (46 cm.) long fastening or anchoring the end to a fixed position in the zone of clean fresh air. If provided with a hand-operated blower it shall permit free entrance of air to the hose when the blower is not operated; and the blower shall deliver the amount of air hereinafter specified with either direction of rotation, unless the construction of the blower is such that it can be operated only in one direction.

In a multiple system, whereby more than one man is supplied by one blower each hose line shall be connected directly to a manifold at the blower.

The hose-mask blower shall meet the standard test requirements.

Oxygen Breathing Apparatus

General—These devices shall be complete with all requirements for safe use by specially trained wearers in furnishing protection in irrespirable atmospheres containing no harmful constituent which can be absorbed through the skin.

Each device shall have marked on it distinctly the name and address of the manufacturer, and the name, letter, or number by which the device is identified.

The regenerating material shall absorb from the expired air carbon dioxide to the extent that not more than 2.5 per cent shall at any time be present in the inspired air. The average shall not exceed 1 per cent for the duration of the periods of test. This average is to be determined by the analyses of air samples taken as near the point of inspiration as practicable and at uniform intervals of time.

(Continued on page 32)

Occupational HAZARDS

DECEMBER 1939

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Irving B. Hexter, President — L. P. Aurbach, Vice-President
W. S. Papworth, Associate Editor — Ralph Phelps, Representative

THERE'S PR

An Employer Look t th

MOST COMPANIES and individuals will agree that improvement in industrial hygiene is advisable from an altruistic angle. There are many who have not had the opportunity of proving that a betterment will usually result in lower operating costs, and therefore an effective expenditure for improving working conditions is a *good investment from the dollars and cents angle.*

The St. Joseph Lead Company is one of the oldest and largest mining and smelting companies in the United States. Twenty years ago, before there were many laws covering industrial hygiene, the company realized that, in order to prevent its best men from entering possibly more attractive fields, it was necessary to have the best possible living and working conditions, so that a man could satisfactorily raise his family by sending his children to good schools and maintaining his and their health. From the following, in which the cost of labor turnover is estimated, it can readily be appreciated that we were not solely influenced by any legal, paternalistic or altruistic angle, but actually by a practical money-making viewpoint.

Labor Turnover

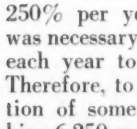
In 1918 our labor turnover was 250% per year, in other words, it was necessary to employ 250 new men each year to keep 100 on the job. Therefore, to maintain our organization of some 2,500 men, we had to hire 6,250 men per year.

Based on an estimated direct cost of $20 to $25 to replace one man in 1919, the direct cost of 1919 labor turnover was $125,000 to $150,000 per year, which is the minimum figure, as it is difficult to estimate the indirect costs, such as additional supervision, increased accident hazard, decreased efficiency among older employees because of the necessity of giving attention to new employees, etc., but it is probably safe to say that the indirect equaled the direct cost; therefore the total cost of the labor turnover was $250,000 per year. I might add that under present day conditions, where machinery and brain work is necessary, instead of costing about $21.00 per man, the figure is nearer $100.00.

By 1926 labor turnover had been reduced from 250% to 40% per year, and by 1933 to 4%. Last year it was 3.6%—just compare this figure with the condition existing 20 years ago.

Analysis

The actual dollars and cents saving indicated by the above was due in part to the fact that investigation among workers indicated that they quit work because of unhealthy or dangerous working conditions. Before taking any definite steps to rectify this condition, we made a study of our employment, working conditions,



wages, hours. We also looked into the training of workers, their safety, living conditions, and the degree of their economic security.

One of the results of this study was the institution of a system of physical entrance examinations in order to avoid placing men on jobs for which they were physically unfit. This practice was and is most beneficial for men and company alike, as unknown physical defects have been found and also limitations, such as a weak heart, etc. I wish to emphasize definitely the *mutual benefit* of initial physical examinations as well as current ones made every two or three years. If a current examination shows that an employee cannot carry on with his job, he is shifted to a new position and he is paid the prevailing rate for the new job, even if it is lower than his former basis. If no job is available, or if he cannot work with safety to himelf and his fellow employees, he is then pensioned. I know of no case where the employee was discharged because of his physical condition.

At our smelter there were 64 lead poisoning cases in 1920 in an organization of 400 employees. A study was made on the hazard, and as a result semi-annual general physical examinations and weekly physical inspections were instituted, a modern change room and a cafeteria were provided. Arrangements were made for employees to wear work clothing supplied and laundered by the company, and all employees were advised as to the importance of personal cleanliness in combating the lead hazard. A resident doctor not only examined the men, but also made periodic plant inspections to check conditions that might adversely affect health. As a result of careful supervision, lead poisoning is no longer a problem. As a matter of fact we have not had a case of lead poisoning for the last ten years.

Insurance

Our miners could not obtain life insurance coverage, except at prohibitive rates, so a group life insurance plan was inaugurated, whereby each employee was given up to a maximum of $2,000 insurance at no cost to himself, and was permitted to buy $2,000 more at a low rate. A pension plan was instituted and has been revised from time to time.

' SPROFIT IN PREVENTION!

Look*t the Dollars and Cents of Industrial Hygiene*

by ANDREW FLETCHER

VICE-PRESIDENT, ST. JOSEPH LEAD COMPANY
VICE-CHAIRMAN, AIR HYGIENE FOUNDATION

In addition to saving money through reducing labor turnover, an efficient and competent safety department was developed.

The "money" results secured are indicated by the following statistics:

Frequency, or number of accidents per 1000 shifts worked has been reduced from .90 to the last five year average of .18

Severity, or number of shifts lost because of accidents per 1000 shifts worked, has been reduced from 12 to 5

Cost of accidents per $100 of payroll has been reduced from $2.25 to $1.25. A saving of $1.00 per $100 on a payroll of approximately $4,000,000 means a saving of $40,000 per year.

Rehabilitation

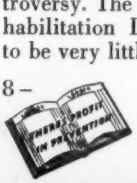
After an injured employee recovers from the immediate effects of an injury, he becomes restless and unless he be given something to occupy his time he may, through self-pity, become discontented and consider himself ill-treated, and when he returns to his regular work he is less cooperative and trouble is likely to develop between him and his foreman. We have therefore developed Rehabilitation Departments where injured employees are given work, at prevailing wages, as soon as possible without danger of adversely affecting their recovery. They are thus permitted to earn while they are convalescing and are usually willing and anxious to resume their regular duties as soon as they are able to do so. It has made the payment of accident compensation practically a routine matter, only rarely resulting in a controversy. The cost of operating a Rehabilitation Department has proven to be very little in excess of the value of the work performed by the injured employees. So again an action that was taken purely for the benefit of the employees has proven beneficial to the employer.

Another way that we have found for making our men more contented as well as saving money is by always endeavoring to make each individual job as "interesting" as possible. We have found that the American employee does very much better and more efficient work if the job is interesting and requires some "brain" work. Along this line we have endeavored to eliminate as much hard manual work as possible.

Although I cannot subscribe to the theory that all dusts are hazardous until proven harmless, I do know that working in dust is unpleasant, even if it is not injurious. I was and am convinced that with just a little thought and comparatively a small expenditure of money, the amount of dust can be enormously reduced. The easiest way to reduce dust is to take dust samples of representative operations at fixed intervals of time, even if only once a month, place the results on a chart and send it to the main office of the company, as this procedure, which costs practically nothing, will result in some executive giving the matter of lessening the dust a little thought.

Dust In Drilling

In one division, we reduced the dust in stopping operations, for example, from 40,000,000 to less than 10,000,000 particles per cubic foot merely by insisting on wet drilling, including collaring the hole wet, wetting down before blasting and mucking and increasing the ventilation by the



use of a fan. With the exception of the fan cost, the expense was negligible, and our Division Manager estimates that he would require at the present time eight or ten additional men per day in a total force of 185 to maintain the present production if a fan had not been installed.

In the sintering operation at another plant, a zinc smelter, a dust prevention and recovery plant was installed at a cost of approximately $26,000. Disregard for the moment the greatly improved working conditions and employee satisfaction, the minimum saving per year is over $5,000, and therefore the installation will pay for itself in less than six years. But the following example of making money is even more satisfactory—at the same Division some $13,000 was expended in improving working conditions in the furnace basement, and as the result it is estimated that the recovery in the furnaces has been improved by over 1%. This saving seems very small, but it is one which will more than pay for the operating cost of the installation, refund the entire $13,000 investment in one year, and show a profit of about $13,000 each year thereafter.

I strongly urge that progressive companies currently obtain information as to dust, fumes, and other hazardous substances, under prevailing working conditions. It is even advisable to have this data prepared by a disinterested and recognized authority in the medical or engineering field of industrial health, because if the information is secured by the company's own employees, it is often disregarded by Compensation Committees or the Courts on the basis that it is prejudiced, just as is often the case when the data has been obtained by so-called "experts" after cases have been filed, and when it is necessary to prove that the conditions then found were the same as those prevailing before or at the time of the alleged "accident."

Above all, let me reemphasize that proper industrial hygiene and preventive efforts pays real dividends—not only in healthy employees, but in actual dollars saved.

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the Accepted STANDARD OF MERIT

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Caused By

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Distributors in 30 Principal Industrial Areas.

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INDUSTRIAL SKIN PROTECTION MILBURN CO. DETROIT MICHIGAN

The Importance of a Safe Work Place

By Edward R. Granniss, *Director*
Industrial Division
National Conservation Bureau

THE creation and maintenance of a safe work place is the objective of safety engineering. To reach this objective involves many and varied activities. One of the most important is to train the worker in safe practices so that he will not be a hazard to himself or to others. Another is to acquaint supervisors with their responsibility for safe job operation. The most effective background for such educational effort is a work place which is physically and mechanically free from danger.

Protection for the head should be provided wherever there is danger of falling objects.

It is sometimes said that "the best safeguard is a safe workman." This statement is open to question. There is no doubt that other conditions being equal, properly trained men will have fewer accidents than haphazard workers. Nevertheless no man is infallible, and if constantly surrounded by serious accident possibilities, sooner or later he will probably succumb to one of them. Moreover, environment has much to do with educational processes, and the attitude of a man working in the midst of disorderly and unguarded conditions is likely to be affected adversely.

Accident Causes

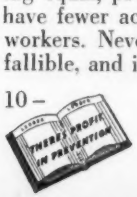
Accident factors may be separated logically into two main classifications:

(A) Unsafe acts of persons (faulty behavior)

(B) Unsafe physicial or mechanical conditions (faulty environment)

The line of demarcation between (A) and (B) is not always clear. Frequently an unsafe condition is created by an unsafe act, as a man leaving a guard off a machine, or failing to clean up oil from the floor. Similarly, an unsafe mechanical condition may be the immediate reason for an unsafe act, as a guard rail left off a floor opening, tempting the worker to jump over the opening. These two headings, nevertheless, indicate the two approaches to accident prevention work. For unsafe acts of workmen, safety education will probably be necessary. For dangerous plant conditions, engineering revisions, repairs and guarding suggest the type of correction.

But here again we cannot afford to be dogmatic. The most practical



Eyes need protection from flying objects, fumes, gases, smokes, dusts, and liquids.

corrective action for an unsafe practice will not always prove to be education, nor will the best way to eliminate the danger from an unsafe material condition always be physical revision or guarding.

The relative importance of (A) and (B) has long been a matter of discussion. It has been frequently stated that from 70% to 85% of all industrial accidents happen because of unsafe acts of persons, while from 15% to 30% are due to unsafe physical or mechanical conditions.

Survey

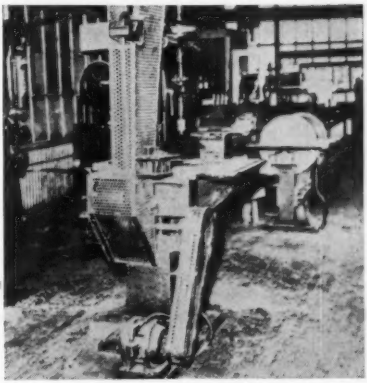
Early in 1939 a survey of 1000 industrial accidents which had been investigated as carefully as possible and analyzed impartially was made. The results of this survey indicated that 20% of the accidents were due to unsafe acts of persons, 20% exclusively to unsafe physical conditions, and the remaining 60% to a combination of both causes, the elimination of either one being sufficient to have prevented the accident. Thus it would seem that through the elimination of all physicial accident causes in a plant, 80% of the accidents might be eliminated while a like result might be obtained through a perfect educational system. The interesting part of this survey is the indication that more attention should be given to faulty environment. Whether or not the proportions of this statistical sampling will hold for a larger survey remains to be seen.

Physical Environment

Both classifications, (A) and (B), may be broken down into further subdivisions. But in this discussion we will have time to consider only faulty physical environment.

We can break down faulty environment into six sub-items:

1. Hazardous building or equipment arrangement, procedure, etc.



Enclosures, covers, barricades, will prevent injury to workmen. Such devices make it difficult for the most careless worker to be injured.

SAVE FINGERS SPEED JOBS

with #15 Safety Tongs and #2 Vacuum Lifters

Safety Tongs; Vacuum Lifters; sheet metal Lifting Hooks; Guards; Ejectors; Gloves and FACE SHIELDS are all included in our line of safety equipment. We've had more than twenty years of experience in helping make industrial plants safer. Send us your inquiries.

The BOYER-CAMPBELL COMPANY
6547 Antoine St., DETROIT

2. Improper illumination.
3. Improper atmospheric conditions.
4. Defective substances.
5. Improper guarding.
6. Improper wearing apparel.

Hazardous building or equipment arrangement probably constitutes the greatest accident exposure. It may include many things, such as bad floor conditions, poor equipment and material arrangement, slovenly housekeeping, etc.

Lighting

Improper lighting has been estimated as causing from 15% to 25% of all industrial accidents. How accurate these figures may be it is impossible to say, but we do know that poor lighting is a contributing factor in a great many accidents. Workers are injured not only because they do not see objects distinctly, but because poor lighting produces fatigue from eyestrain, a further contributing cause of many accidents. Adequate daylight illumination, properly applied, is the ideal form of lighting. Plant operations, however, require that employees work from 20% to 50% of their time under artificial light. Fortunately, it is altogether possible to obtain satisfactory artificial illumination for practically any type of industrial operation.

Air Hygiene

Atmospheric conditions involve four basic factors. These are temperature, humidity, air movement (freshness) and air cleanliness. Increased

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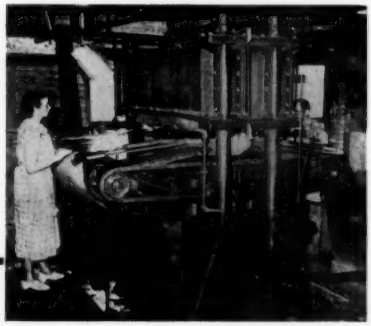


Machines designed for safety minimize the possibility of injured workmen.

DERMATITIS

caused by the

Chlorinated Hydrocarbons

. . . A Review of Preventive Measures

THE fact that a group of industrial chemicals are called "chlorinated hydrocarbons," at once suggests the desirability of finding out what, in ordinary shop language, these substances really are. As is usually the case with organic compounds, they and their derivatives are exceedingly numerous.

Some of the more common ones, and the ones studied for this article are: chlorinated naphthalene and the derivative waxes, asphalts, and synthetic resins; chlorinated diphenyls; penta and hexachlornaphthalenes. These compounds under some conditions can do serious damage to the skin and respiratory system. We consider here the hazard to the skin—dermatitis caused by contact with chlorinated compounds in their various forms.

The chlorinated hydrocarbon compounds, and particularly diphenyl and chlorinated naphthalene, will, when in a molten state, evaporate to form hazardous vapors. These vapors may condense on the cotton fibres of a workman's glove, on the wool fibres of his suit, upon tools and ladles, or upon the skin of the workman. When the condensed vapor cools on the skin or clothing of a workman, it forms a wax, exceedingly difficult to remove unless a solvent such as carbon tetrachloride is used. Similarly, the condensation on the clothing brings the chemical into contact with the skin of the worker. As is the case with most skin irritants, prolonged contact of this condensation with the skin immeasurably increases the danger of infection.

In addition to contact with the vapors, it goes without saying that irritation of the skin can very easily result from contact with the liquid itself. Splashing, dripping, and careless handling are assiduously to be avoided, and production should be planned to permit a minimum of handling and exposure.

The irritation of the skin caused by these chlorinated hydrocarbons is so well known that we need not dwell upon it here. The problem is to determine what measures may be taken to protect the worker from harm and disability. In several plants studied, very satisfactory hygiene programs have been developed, and the good results of this work points the way for all industry to minimize or eliminate the hazards. With the elimination of the hazard goes also the occupational disease, the lost time and expense it brings about.

Worker's Responsibility

Let's have a look at the worker

himself, to see what part he must do, in those plants studied, in keeping himself free from dermatitis.

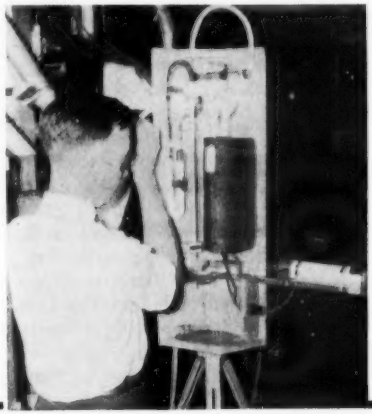
When he comes to work in the morning, he first goes to the locker room expressly set aside for clean street clothes. Here he undresses, puts his street clothes in a clean locker. Nothing is ever kept in this particular locker but street clothes. In some cases he is given a clean suit of underwear, furnished by the company. The company also pays for the laundering of the underwear, and he is furnished with one-time paper slippers which he uses to walk to the separate work clothes locker room.

After having put on his work clothes, the worker applies a protective ointment to all exposed portions of his body. The ointment is furnished to the worker by the company without cost, and its use is insisted upon.

Whenever the worker washes, either at the close of the work period or as a result of becoming excessively dirty, he must re-apply the ointment to the exposed areas of the skin.

At lunch time, the worker must wash thoroughly, and then take his lunch to the lunch room provided by the company. This lunch room is separate from the plant to prevent the possibility of any irritants getting into the lunch room. If the worker leaves the company premises for lunch, he must remove his work clothing, go into the street-clothes locker room, and dress in street clothes.

After work the workman removes all his work clothing in the locker room, puts his outer clothing in his locker, deposits the underwear in a hamper to be laundered. He is then required to go from the locker room into the shower room where he is required to take a thorough shower. He is supplied with soap and clean towels. Then, into the other locker



Proper determination of the amount of fumes and mists of the chlorinated hydrocarbons in the air is essential in designing and operating a preventive system.

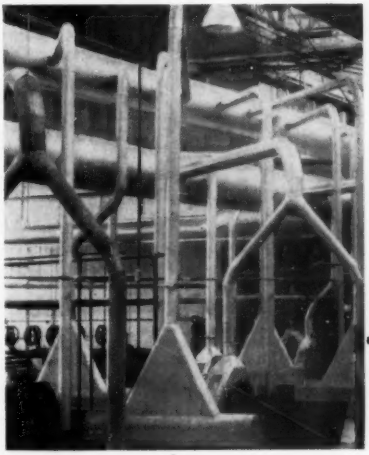
Personal hygiene—clean clothes, frequent adequate washing, protective creams, and adequate sanitary facilities will do much to prevent dermatitis caused by the chlorinated hydrocarbons.

room to put on his street clothes.

You will notice that this whole program is designed to make as short contact with the irritating substances as possible. Every opportunity to clean the skin of the worker, and keep it clean, is taken. The essence of dermatitis prevention is keeping the irritants away from the skin.

Personnel

Even with the thorough precautions taken above, it is sometimes found that a particular worker is unduly susceptible to skin infection. Long experience has indicated that dermatitis caused by chlorinated hydrocarbons is less frequently encountered in mature men and that dark complectioned men are less susceptible than blondes. The suggestion has been made that employment of adolescents be avoided, and that the employment of light skinned men under such conditions be avoided or be managed carefully.



Exhaust systems to remove fumes, vapors and mists at their source will prevent the contaminants being released into the air—where contact with workers' skin will cause dermatitis.

Protective Clothing

We mentioned above the precautions of cleanliness taken with the workers. To go even further than this, experience has proved the wisdom of providing workers with coveralls, full-length underwear, gloves, and caps. These, generally, have been supplied by the company. Socks and shoes need not be supplied, but wear of proper ones is to be encouraged.

Arrangements should be made to launder the work clothing supplied the workers, preferably as often as three times a week, and in some cases, every day.

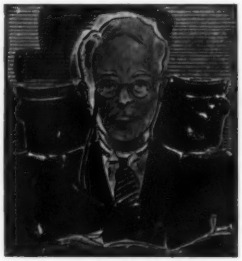
Plant Engineering

Personal protection of the worker is half the battle. The other half is engineering. Control of process, control of fugitive irritants, orderly routines—all are necessary if men working with chlorinated hydrocarbons are not to be liable to contract dermatitis.

An essential part of dermatitis prevention is proper exhaust systems to remove vapors arising from the process equipment. This is probably the most important single factor in preventing chlorinated hydrocarbons from becoming a problem.

In many cases the compounds are heated. The recommended course is indirect heating by means of oil jacketed equipment, heat being transferred by the hot oil to the compound being heated. Improper heating not only has important hygienic implications, but may easily cause defects in the process. *(Continued on page 21)*

Right off the Docket



The trend of litigation on workmen's health and accident compensation is reflected in these briefs of the latest and most representative cases coming to trial in the intervals between issues. Familiarity with this trend is important to every industrialist.

Undue Exertion Causing Strain of Previously Weakened Heart Brings Award

The claimant's husband, a city fireman in Paterson, New Jersey, was on duty when a fire alarm sounded. He, and two others mounted the fire truck and proceeded to the fire. The claimant's husband was a hoseman, and when the scene of the fire was reached, he pulled the hose from the truck, attached it to the fire hydrant, and then ran some 300 or 400 feet to report to the fire chief. He was told to turn on the water and ran back to the hydrant to do so. The water was turned on, and subsequently the claimant's husband was found slumped over the hydrant, unconscious. A doctor examined him, and pronounced him dead, giving his opinion that the death was due to acute cardiac dilation.

The defendant contended that the deceased did not die from an accident arising out of and in the course of employment, but that his death was due to natural causes; that he had been suffering from hypertensive heart, arteriosclerosis, and high blood pressure. The Commissioner in making an award, stated: "In the case at bar, I am convinced that had the decedent not answered the alarm on the day in question, which was a very warm day, and been put through the various acts of physical exertion testified to, and the excitement that always accompanies the answering of a call to a fire, he would not have died of acute heart dilation on that day. There is no question in my mind that the death taking place on that day in his impaired state of health was due to the demands made upon him by his employment."

Moore vs. City of Paterson (N.J.) New Jersey 8 Atl. 2nd 251 (September-1939)

Court Rejects Claim that Baling Machine Run By A Tractor Makes Farm a Factory

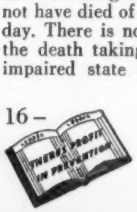
The claimant was engaged as a baler of hay. He baled for various farmers, operating the baler by means of a motor driven tractor. While baling, dust got in his eye, injured it, and disability resulted. Despite the fact that the Workmen's Compensation Act excepted persons engaged in agricultural labor from its provisions, the claimant sought an award on the theory that the power driven baler made a "factory" of the farm under the terms of the Compensation Act which defined a factory as any "premises wherein power is used in manufacturing, making, altering, adapting, ornamenting, etc., any article for the purpose of trade or gain."

The Court rejected this argument. It said, in this case the nature of the work was purely and inherently agricultural. The exception of agricultural workers under the statute, is too clear, even under a liberal construction to hold that this employee is within the act.

In Re Roby (Wyoming) 93 P. 2nd 940 (Sept.-1939)

Two Hernia Cases

In the first case, the claimant while at work, reached across a table to get a heavy bolt of apron cloth. She suddenly felt a



sharp, cutting pain in her right side. That night she found that the part of her body where she experienced pain was puffed up. The claimant had never previously had pain or swelling of her side. The Court held that the evidence was sufficient to show the hernia was the result of, and immediately followed an accident, and was compensable.

In the second case, the Court held that the following evidence warranted an award. The claimant was unloading trucks and transferring cans of ice cream weighing about 45 lbs. each. While engaged in this work he became very sick, and developed a severe headache. That night when he arrived home and undressed he noticed a bulge on his left side, down low, and nearly as large as an egg. He continued to carry on his duties waiting on customers, but did no more loading or unloading. About a month later he consulted a doctor and was told he had an indirect lingual hernia.

Hancock vs. Troy-Parisian Co.—(Idaho) 94 P. 2nd 674 (Sept. 1939); Cook vs. Winget (Idaho) 94 P. 2nd (Sept.-1939)

Award For Ruptured Stomach Caused By Two Accidents—Court Upholds Commission's Findings

On August 9, 1937, the claimant was working at a lathe when a wrench handle flew off hitting him in the stomach, knocking him backward on to some machinery. The company doctor taped his back and stomach. He continued to work. On September 17, 1937, the claimant was lifting a brake shoe weighing between 75 and 100 lbs. when he was struck in the abdomen by the corner of the shoe. Some eight months before these accidents the claimant had been operated on for a stomach ulcer condition. After the second accident the claimant was unable to work and filed a claim for compensation.

The Company disputed the contentions of the claimant. They claimed that the only disability resulted from a rupture due solely to a gastric ulcer. They denied the accidents. The Industrial Commission after hearing expert testimony for both sides as to the probable cause of the disability, made an award to the claimant.

On appeal, the Supreme Court sustained the Commission's decision. The Court held: "Where in a proceeding before the Industrial Commission the disability alleged to exist is of such a character as to require skilled and professional men to determine the cause and extent thereof, the question is one of science and must necessarily be proved by the testimony of skilled professional persons, and a finding of fact based thereon, when reasonably supported by the evidence, will not be disturbed."

J. B. Klein Iron & Foundry Co. vs. State Industrial Commission (Oklahoma) 93 P. 2nd 75 (Sept.-1939)

School Teacher Gets Compensation for Injuries Sustained in Automobile Accident Held Within Employment

The Claimant, a school teacher, was required by the superintendent to attend a teacher's institute. The Teachers were paid their regular salary if they attended, and were not paid if they did not. The claimant was required to make a report of the sessions. No transportation or accommodations were provided for the teachers.

After attending the first meeting of the institute, the claimant was being driven in a friend's car to the place where she was going to spend the night, when she was injured in an automobile collision. The Commission refused to grant an award on the ground that the claimant's injuries were not suffered in the course of her employment.

In reversing the Commission and allowing an award the Court stated: The circumstances of the instant case show that at the moment of injury the appellee was performing duties incidental to her employment and a necessary part of her trip to attend the institute. She had to eat somewhere and sleep somewhere. The employment had some causal connection with the injury, either through the activities, its conditions, or its environments. Bower vs. Industrial Commission of Ohio (Ohio) 61 Oh. App. 469 (April-1939)

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New Light on INDUSTRIAL HAZARDS

PART II

By Harris Reinhardt

Commercial Engineering Department
Westinghouse Lamp Division
Bloomfield, N.J.

High Intensity Mercury Vapor Lamps

High intensity mercury vapor lamps since the introduction of the 400 watt lamp now known as the A-H1 in 1934 have filled an important place in industrial lighting. Among the more important types now available are the 250 watt, type A-H2 and the 100 watt, type A-H4. These lamps must be burned in conjunction with suitable auxiliary equipment and give a bluish green light which is produced at a comparatively high efficiency and is preferred for many types of industrial operations particularly in the automotive industry and in the heavy industries such as steel mill and foundries. When combined with incandescent lamps either in a single unit or in a suitable staggering of units of both types the deficiency in red rays in the mercury lamp is balanced by the excess of these rays in the incandescent lamp and a light remarkably similar to daylight in appearance is produced. This type of lighting has been popular for applications where the color of the mercury light is not suitable. Because of their high efficiency and the attention compelling power of their distinctive color characteristics both the high intensity mercury vapor lamps and the sodium vapor lamps are well adapted to floodlighting of the exterior of industrial plants and adjacent areas such as yard and parking spaces. Such lighting is an important step in providing safety for employees in plants which operate a night shift.

Fluorescent Lamps

One of the most fascinating of the newer light sources is the fluorescent lamp which employs an entirely new method of producing light. The basis of the lamp is a low pressure mercury discharge which is weak in visible light, but contains a wealth of invisible ultra violet radiation. The inside surface of the tubular bulb of the lamps is coated with certain fluorescent chemicals which have the property of absorbing this ultra violet energy and converting it into visible light. The color of this resultant light depends upon the characteristics of the fluorescent chemicals. All of the lamps listed in the accompanying table are available in white and daylight and all except the 40 watt, 48" lamp are available in 5 additional colors, blue, green, gold, pink and red.

Fluorescent Mazda Lamps

Watts	*Length*	*Diameter*
15	18"	1"
15	18"	1-½"
20	24"	1-½"
30	36"	1"
40	48"	1-½"

The daylight lamp is of greatest interest in industrial installations since it offers a means of producing a high level of light of daylight qual-

ity without the generation of excessive heat.

Although the fluorescent lamps produce light at high efficiency they are essentially low wattage sources and hence not economical for the general lighting of large areas because of the large number of lamps which would be required. Their principal application in industry is therefore in supplying a high level of illumination over restricted areas particularly in installations where light of daylight quality is essential.

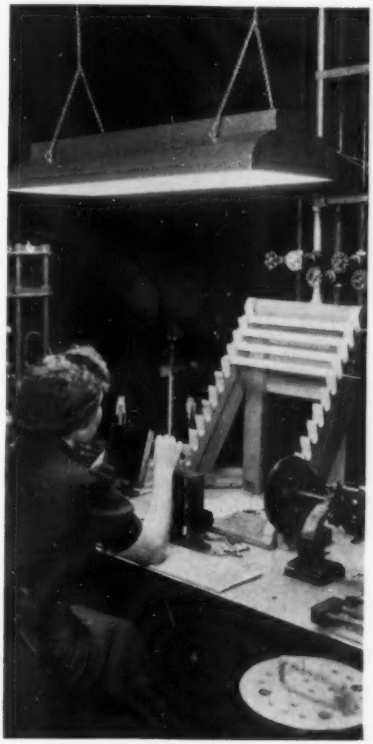
The daylight fluorescent lamp produces around 35 lumens per watt of light of daylight quality which is, roughly, between 3 and 4 times as efficient as daylight incandescent lamps. Thus it makes available an important tool for use in many color matching operations. The light produced by these lamps is not a perfect daylight due to the presence of certain of the visible lines in the mercury spectrum which play no part in the fluorescent action, but are present in addition to the daylight produced by fluorescence. This may mean that the light will not be entirely satisfactory for very exacting color discrimination, and a trial installation should be always arranged when the use of the lamps for this purpose is contemplated. Each lamp must be burned in conjunction with a suitable auxiliary which contains a relay essential to the starting of the lamp and a choke coil which limits the current.

Stroboscopic Effect

In an alternating current circuit, the voltage falls to zero twice in each cycle which means that lamps connected on a 60 cycle circuit are flashing off 120 times each second. The human eye is not capable of noticing such a rapid flicker and in the case of an incandescent lamp there is considerable carry-over of light due to the fact that the filament has a certain heat storage capacity and the light does not go completely to zero.

With the fluorescent lamp, however, this dark period is definite and though still too rapid for the human eye to discriminate may give rise to a stroboscopic effect. If there is ma-

High intensity mercury vapor lamps are used to advantage in general illumination as well as in work requiring high concentrated candlepower.



chinery in the vicinity which happens to be revolving at certain speeds, for example, it may appear to be standing still or turning much more slowly than it actually is.

In one of the most promising fields of application of fluorescent lamps—the textile industry—this does not seem to produce much annoyance since work is done on the machines only when they are not in motion. In instances where it is found annoying, it is partially eliminated in a three-lamp unit by connecting each lamp on a separate phase of a three-phase system, and may be reduced in a two-lamp unit by means of a special type of control unit which operates one lamp with a leading power factor. The latter method has the advantage of bringing about some correction in the power factor of the complete circuit which is otherwise around 60 per cent.

This matter of power factor, in fact, may become of some importance, particularly in a large installation. Other means such as the use of specially designed condensers are also available for the correction of power factor.

Reflector for Fluorescent Lamps

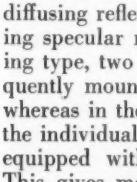
Fluorescent lamp reflectors for industrial applications are usually made in the form of trough units, containing one or more lamps. There are two types of troughs for this application on the market—those employing diffusing reflectors and those employing specular reflectors. In the diffusing type, two or three lamps are frequently mounted in a single trough, whereas in the specular type, each of the individual lamps in the trough is equipped with a separate reflector. This gives more accurate control of the light which also means that there is less danger of glare from normal angles of viewing. The illumination produced on a horizontal plane three feet below a unit of this type employing three 40 watt, 48 inch daylight fluorescent lamps is shown in the accompanying illustration. The shape of these troughs are ideally suited to supplying a high level of illumination over limited work areas and units of this kind are finding a very important place in industrial lighting.

Summary

Summarizing our survey of recent progress in industrial lighting we have observed that advancement in this field is essentially along two important lines; 1—advancement in our knowledge of the seeing requirements of various industrial operations, 2—improvements in the tools of industrial lighting and in the methods of effectively using these tools to meet these seeing requirements.

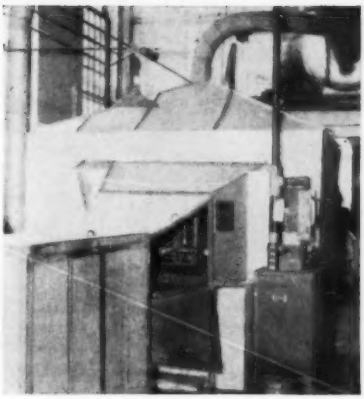
An encouraging trend is indicated by a report of a recent survey conducted by the I.E.S. which gave the average level of illumination in industries in this country as 7.5 foot-candles. While this falls far short of the levels which are considered essential for efficiency and safety, it indicates a trend in the right direction and there is every reason to believe that the new tools of industrial lighting together with a more general appreciation of its benefits will cause this increase to continue at an increasing rate.

And with proper lighting comes greater production efficiency, greater freedom from accidents, and a lessening of the optic and physiologic health hazards.



DERMATITIS

(Continued from page 15)



In the control of any industrial contaminant or irritant, the free dispersion of which would be a hazard to workmen's health, the process is probably the first thing to investigate. In some cases it is possible to completely enclose certain operations to prevent escape of harmful substances. In this illustration is shown the enclosure used to prevent the escape of certain chlorinated hydrocarbons necessary in the insulation of wire.

It is important to remember that chlorinated hydrocarbon compounds have a rather high specific gravity, with a corresponding vapor density which is high. Because of this weight, ordinary methods of ventilation are not entirely satisfactory.

Process

The most satisfactory method of controlling escaping vapors is to enclose the entire process to the maximum possible degree. Openings for control purposes should be as small as possible; the surface of the liquid should be kept as small as possible to minimize the evaporation. Variations in this aspect will vary from plant to plant. Some processes can be completely enclosed, others only partially so.

The vapors of chlorinated hydrocarbons will, of course, condense on the walls of any exhaust apparatus. It is necessary, therefore, to realize that this causes a certain dimunition of efficiency of the system. To avoid this, the system must be cleaned thoroughly at regular intervals, often as much as once a day.

In order to insure proper operation of exhaust systems, checks should be made twice a week. These should include examination of air samples, and velocity measurements at all air inlets.

It is virtually impossible to make general comments about proper design of exhaust equipment. The factors of process and machine design vary so much from plant to plant that competent exhaust experts should be consulted to insure proper design and efficiency. Most manufacturers of exhaust equipment offer highly competent engineering service in fitting the equipment to the specific problems involved. Most of such manufacturers now realize that in addition to efficiency and economy of plant operation, hygienic working conditions are to be engineered into the plant.

The two-fold objective—protecting the worker, and removing irritating fumes—will point the way to minimizing of dermatitis caused by chlorinated hydrocarbon compounds.

This month in *Washington*

FACTORY INSPECTOR'S TRAINING COURSE

By W. T. CAMERON, Chief Safety Adviser
Division of Labor Standards, U. S. Department of Labor

The growing realization that satisfactory inspection departments have both a duty and an opportunity far beyond that of mere enforcement has led to the development of a series of short but intensive training courses on safety and health for such inspection personnel. The eighth course in this series was held in Birmingham, Alabama, October 23 to November 4 inclusive. It was conducted under the joint auspices of the Alabama Department of Industrial Relations and the Division of Labor Standards, U. S. Department of Labor. The University of Alabama and Alabama Polytechnic Institute acted as joint sponsors. Inspectors from Alabama, Arkansas, Colorado, Florida, Georgie, South Carolina and Tennessee attended.

The short courses (of which that held at Birmingham was typical) are devoted to fundamentals. The subject of injury prevention in industry is far too broad for detailed treatment in so short a course and it has been necessary, therefore, to confine the teaching to subjects of basic importance.

Since the great majority of injuries result from hazards and conditions common to substantially all industries, major emphasis is placed on recognizing and correcting them. It is obvious that if a State safety inspector is to render a truly effective service to the cause of prevention, he must have a broad understanding of accident sources and the conditions that lead to accidents. He must be able to appraise these conditions, evaluate the effectiveness of the preventive program of each establishment and advise as to means of improvement. In other words, he must be a valuable and valued consultant. His role as an enforcer of safety and health laws and of requirements under such laws is a necessary and advantageous

foundation on which he can build a highly valuable service of prevention.

The course consists of lectures, inspection trips to selected plants, discussion of conditions found, question and answer periods, and verbal and written quizzes. Subjects not covered in the classroom are assigned for evening study and are included in the quizzes. The work of each student is graded. All quiz papers are returned to the students. Quiz questions are discussed in class and correctly answered.

Well in advance of the school the course director carefully selects the plants to be used, each being chosen to exemplify specific things. In the main, the purpose is to show good practice, though an occasional example of bad practice and its relationship to the accident rate is chosen. At this point a well deserved tribute is gladly paid to the excellent cooperation of managements in general. A refusal of permission to make such use of a plant is almost never met with. In view of the fact that such an inspection visit by several squads of inspectors involves considerable inconveniences to the management, the wholehearted cooperation met with speaks eloquently of their wide recognition of the need and value of a competent safety service.

The subjects covered by lectures included:

Safety—Injury sources and causes, accident costs, accident rates, machinery safety, transmission machinery, common point of operation machines, housekeeping and safety, preventing falls, hand tool safety, personal protective equipment, accident investigation, inspecting for accident hazards, selling safety to the plant management, organizing for safety, safety in purchasing, first aid and safety codes.

Health—Practical methods that are in effect in specific industries, occupational environment, factors affecting the health of workers in places of employment, control of health hazards, inspecting for health hazards, industrial dusts, silicosis, carbon monoxide, solvents, plant sanitation.

This course is regarded as part of a continuing program of training for this personnel, chosen to render in their respective States an ever increasingly valuable service of prevention. Such a service at the expense of and under the authority of the State is seen as the means of carrying the gospel of safety to the multitude of small employers. It can be most effective precisely where volunteer effort can do little, namely with the small employer who must be sold the idea that occupational injuries are a preventable waste and be stimulated to undertake their elimination.

The Sixth National Conference on Labor Legislation was held in Washington on November 13. Representatives of the Governors of 39 States and Alaska and Puerto Rico attended. This conference, called by the Secretary of Labor, included State Commissioners of Labor, Administrators of State workmen's compensation and unemployment compensation laws, and representatives of labor organizations.

Experience of the States and the Federal Government with the Nation's wage-hour law were discussed. Particular attention was paid to the subject of preventing industrial disease and accidents, and to standards of workmen's compensation.

New Products

SHOWERWAY is the name of a new, portable hand washing fountain manufactured by the Lyon Metal Products Company. The three models make the Showerway exceedingly adaptable. Most significant feature is the shower spray, which is highly convenient, and has great hygienic value.

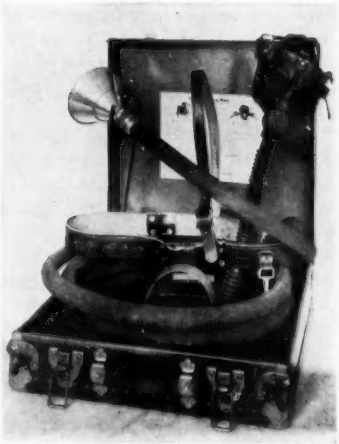
HAND CLEANER just produced by West Disinfecting Company, is called Lan-O-Kleen. The new cleaner has a base of corn meal impregnated with lanolin, and has the hygienic attributes of lanolin. The particular use for Lan-O-Kleen is the removal of grease and stains from the skin without irritation.

INDUSTRIAL VACUUM CLEANERS manufactured by the Ideal Commutator Dresser Co. will henceforth feature two new safety features: a three-wire ground cable to protect the operator from any shorting shocks from any cause; and a fine filter screen covering the motor to prohibit the entrance of excessive dirt and dust. Should the cleaner be used in the presence of inflammable substances in the air, the screen will keep any ignition of gas within the housing, thereby preventing a hazardous condition from the ignition of any such substances.

THE BULLARD SIMPLEX HOSE MASK has been granted the approval of the U. S. Bureau of Mines for protection against high concentration of fumes or oxygen deficiencies in cases where the maximum length of hose does not exceed 75 feet.

The mask implies no blower. Air enters the hose through a funnel placed in fresh air. Through the hose the air reaches the wearer giving the protection desired.

METAL MERCURY SWITCH for making electrical contacts in the presence of hazardous or explosive substances is now available from Durakool, Inc. Requiring a very minimum of energy to operate, the switch has many applications in starting emergency equipment. It is also adapted to



Additional information and descriptive literature on any of the products mentioned in this service department may be obtained by writing ***Dept. N,*** OCCUPATIONAL HAZARDS & SAFETY, *812 Huron Road, Cleveland, Ohio.*

IN THE FIELD

general industrial use because of its high capacity, durability, and safety feature.

ALZAK ALUMINUM reflector for flourescent lamps is announced by the Benjamin Electric Manufacturing Company. The twin lamp unit is designed to produce from 100 to 150 foot candles with the 40 watt, 48 inch lamp, at a distance of 3 to 4 feet

from the work. For either close work of this sort requiring high concentrations of light or for general over-all lighting, the new reflector gives a maximum of effective lighting with ease and simplicity.

DISPERSER for washroom use of hand cleaners that gives an average of 2000 washes per pound of soap is announced by Lightfoot Schultz Co. Tamper-proof, waste-proof, and very simple in operation, the dispenser is designed to provide adequate and efficient distribution of hand-cleaners.

AFTER A YEAR of tests in industrial plants, Apex Alkali Products Co. are now making available their "Derma-Tex," a protective cream for preventing dermatitis caused by cutting oils, paints, lacquers, solvents, and other industrial irritants.

WELDING HELMET made of vulcanized fibre, with easy lens removal has just been announced by the Chicago Eye Shield Company. The shield is reinforced on each side with ribs moulded in the fibre to give strength and eliminate warping. The shield is light weight, and seamless.

A NEW DRESSING for burns, named Foile, and distributed by Mine Safety Appliances Company, has truly phenomenal qualities. Actual case histories report almost unbelievable cures of severe burns. Easily applied, Foile controls pain, and is especially valuable in effecting a healing

with a minimum of distortion of skin surface due to formation of scar tissue. Foile also has marked antiseptic qualities.

Statements made in connection with any product mentioned in this service department are based on manufacturers claims. Although these claims are believed to be true, this magazine does not guarantee that to be the case.

A PUBLIC HEALTH DOCTOR *looks at the* PROBLEMS IN SAFE HANDLING of CHEMICALS

IN INDUSTRY chemical substances may poison: 1. By *ingestion*, the least frequent method, and usually only secondarily, due to the swallowing of dust entering by mouth or nose; 2. By *inhalation*, as dust, vapor, fume or gas (the most frequent method of entry in industry); or 3. By action, (a) on the skin, producing localized inflammation, or (b) on the general system, by absorption through the skin and distribution through the circulation to cause systemic poisoning. Practically all of the fat or oil solvents are likely to produce poisoning by this route.

Physical State in Which Chemicals Harm

Chemicals may do harm as:

1. *Dusts*, which may be, (a) *infective*, associated with disease producing organisms, as in tuberculosis from inhaling dust contaminated by expectorations from fellow-workers; (b) *obstructive*, not definitely poisonous, but by mass action (when in excessive amount) interfering with secretion and producing local irritation in eyes, nose, throat, or bronchi; (c) *irritant*, acting locally as chemical irritants as may the chromates which may cause intractable ulcerations on the skin, as in the so-called chrome holes on kid tanners' hands; (d) *soluble and toxic*, being absorbed from gastro-intestinal or respiratory tract and causing systemic poisoning, as may lead, manganese, arsenic, or other metallic dusts and many organic dusts; (e) *fibrosis-producing*, entering the lungs and producing the chronic fibrotic changes of pneumoconiosis or silicosis.

2. *Liquids*, which may be, (a) *irritant*, (b) *corrosive*, (c) *toxic*, or (d) *sensitizing*.

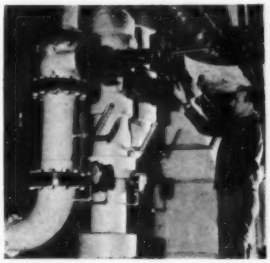
by HENRY FIELD SMYTH, M.D. Dr. P.H.
Assistant Professor of Industrial Hygiene, University of Pennsylvania

Abstracted from a paper presented by Dr. Smyth in the CHEMIST, publication of the American Institute of Chemists

3. *Vapors, fumes* or *gases*, which may be, (a) *asphyxiant*, harming either by simply replacing oxygen in inspired air (as do simple asphyxiants such as carbon dioxide), or by replacing oxygen in the red blood cells (as do chemical asphyxiants such as carbon monoxide); (b) *irritant*, producing inflammation of eyes, nose, throat, larynx, bronchi, or lungs, as do ammonia, which rarely reaches the lungs, but, when in very high concentration, strangles by closing the glottis; (c) *toxic*, as inorganic or organic gases, vapors or fumes which poison the system but do not produce much local lung damage if not in high concentrations, or organo-metallic gases, vapors or fumes such as tetra-ethyl lead (which is absorbable as liquid or vapor via skin or lungs).

Chemical State in Which Chemicals Act

We have just considered the physical state in which chemicals may harm. The chemical state is also of importance. Toxic substances may act in one of three forms: 1: As *direct tissue poisons*, circulating and producing harm as such (for example, methyl alcohol, hydrocyanic acid, cyanates, or hydrogen sulphide); 2. through *intermediate products*, when not fully oxidized, as does phenylene-diamine, the harmful action of which is due to quinones; or through *harmful end products*, as does phosgene gas, the action of which on the lungs is due to the liberation of nascent hydrochloric acid formed by the action of moisture in lungs, alveoli, and bronchi.



Organs Affected

Chemicals may affect: 1. The *lungs*, usually acutely, as do bromine, phosgene, etc.; 2. the *glandular organs*, such as the liver, which is injured by phosphorus, carbon tetrachloride, etc., or the kidneys, which are especially harmed by mercury and phenol; 3. the *circulatory organs*, such as the blood and blood-making organs, which are damaged by benzol and its aromatic derivatives; or 4. *the nervous system*, which is affected by petroleum distillates, carbon bisulphide, manganese, etc. While chemicals often predominatingly act on one of the above tissues or systems, they usually also affect the other systems more or less, differences of action depending on time and concentration.

Degrees of Toxic Action

Effects produced by chemicals may be: 1. *Acute* and immediate, in which case exposures are usually accidents and eventuate, if discontinued promptly, in death or recovery; 2. sub-acute or *chronic*, slowly developing and in some instances not recognized for days, weeks, months, or even years, as may be the case with lead or benzol; or 3. *cumulative*, due to slow elimination and consequent storage in the system, as lead may be stored in the long bones. Such cumu-

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lative poisonings may not be recognized until after the worker has been transferred to another unrelated industry, as may be the case with lead or benzol poisoning. At times these harmful effects, if exposures have been heavy or continued, may progress to a fatal termination months or years after exposure is discontinued, as has happened in some of the cases of radium poisoning.

Measuring Known Hazards

The degree of damage to the average worker, of any material, is dependent first upon the nature of the material itself; then upon the amount of the material to which the worker is exposed or takes into his body; the duration of the exposure; and the temperature under which the individual works.

The degree of exposure may be measured in one of several ways, depending upon the nature of the toxic material: 1. By concentration in the working atmosphere; 2. By milligrams per unit of body weight for materials entering the digestive tract. 3. By milligrams per one hundred cubic centimeters of blood serum, as an indication of the amount actually absorbed and producing toxic effect. 4. By amount excreted per twenty-four hours in the urine, as an indication of the amount having passed through the system.

In addition to the amount of exposure or absorption as measured above, the possibility and extent of toxic action is dependent upon the continuity and duration of exposure. Safe working conditions and concentrations for continuing exposures are measured on the basis of eight to ten hours exposure for five to six days per week, so that a job analysis is essential to determine the risk to particular workers. It is usually possible to stand higher concentrations than the so-determined maximums provided exposures are discontinuous and for short periods.

It must also be realized that high temperatures increase concentrations of volatile matters in the air, and that high temperatures and hard manual work lower resistance and increase amounts of vapor absorbed.

Evaluating Unknown Chemical Hazards

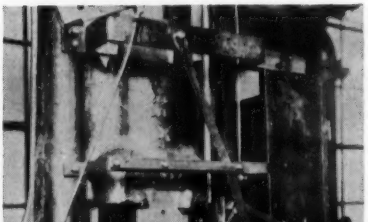
When chemicals of unknown toxicity are being introduced into industry, it is always advisable to determine potential harmfulness *before* general use, rather than after suits have been brought for illness or death of workers. Striking examples of instances where employers have suffered for failure to do this were the deaths in the early manufacture of tetra-ethyl lead, and those among painters of radium clock dials.

A program for such a study, to be adequate, must extend over a considerable time interval in order to evaluate the possibility of slowly developing toxic poisoning, which is the most frequent and the most often overlooked form of industrial poisoning. A preliminary study should determine the acute toxicity or minimum lethal dose (m.l.d) for laboratory animals, but should never end there. The m.l.d. so determined, is used as a basis for chronic toxity work.

(Continued in next issue)

SAFE WORK PLACE

(Continued from page 12)



Machinery with built-in safety devices goes a long way to preventing injury to workmen.

attention to occupational diseases at the present time is causing air hygiene to take on added importance. Toxic substances released in the plant atmosphere should, of course, be removed as near their point of origin as possible. The general movement of air in a factory is necessary for comfort and for the possible reduction of fatigue. Temperature and humidity should be controlled for the same reason.

Defective Substances

Under defective substances may be included accidents from such causes as dull tools, broken handles, defective electrical equipment, as well as those from poorly constructed or designed tools, including improperly annealed punches, wrongly shaped hand tools, etc. It may be of interest to note that one out of every five plant fires is reported to be of electrical origin, half of the electrical fires being due to poor maintenance conditions. Defective wiring is the worst offender, motors are second and switches third.

Machine guarding may be broken down roughly into two classifications, namely power transmission and point of operation.

Point of operation guards may, in turn, be considered under six classifications:

1. Mechanical feeding devices.
2. Hand control devices situated at a safe distance.
3. Tools designed for safety.
4. Devices to prevent or interrupt the movement of tools while hands are in the danger zone.
5. Devices to pull or push the operator's hands away from the danger zone.
6. Enclosures, covers and barricades.

Mechanical Feeding

Mechanical feeding devices are designed to protect the machine operator from injury resulting from contact with parts of the working tools, cutting, blanking, shearing, forming or performing other operations on materials being machined. Various methods are used in mechanical feeding, including rolls, gears, dials, shoots, hoppers, magazine slides, air pressure, vacuum gravity, friction and springs. A mechanical feeding device should make it unnecessary for the operator to place his hands or any other part of his body in the point of operation danger zone and if supplemented by proper enclosures the machine may be made practically fool-proof.

Hand control devices may consist of buttons, levers, handles, or switches so located that the operator must have

all parts of his body at a safe distance from the point of operation when the machine is operated. Dough mixers, punch presses, guillotines, cutters and other machines frequently are equipped with these devices.

Devices which prevent or interrupt the movement of tools when any part of the body is in the danger zone are becoming more popular. With these devices, the tool cannot be set in motion, or if in motion will be stopped, unless the operator's hands are wholly withdrawn from the danger region. Subway car doors used in some cities, are instances of this type of protection.

Devices which pull or push the operator's hands away from the danger zone when the machine is operated have been used widely, but are perhaps waning in popularity at this time. While many excellent safety

Adequate stock and proper fitting encourages the wearing of all-important safety shoes.

records have been produced in plants where these devices have been in use, operators may circumvent the safety features of sweep motion guards unless carefully supervised. As for guards which pull the operator's hands away from the danger zone when the machine operates, many men have objected to the idea of being shackled to their machines.

Enclosures, covers and barricades may be used to isolate the point of operation for some types of manu-

Protective clothing of various kinds is available for most hazardous occupations. This illustration shows guards to protect the legs and feet.

facturing and are also used in conjunction with other guards to good effect. They are similar, of course, to the type of guarding that is used for protection against power transmission hazards.

Wearing Apparel

Improper wearing apparel may be of two types. One includes the improper clothing in which a man may come to work, such as shoes with thin soles, ragged shirt sleeves, long neckties, etc. The other includes protective articles such as goggles, respirators, aprons and safety shoes. Protective apparel reduces or eliminates the possibility of injury when an accident occurs.

There is much to accident preven-

tion besides unsafe physical and mechanical equipment and its correction. Nevertheless, even through inspection or accident analysis an unsafe building, machine, tool or material condition is found to exist, there can be little doubt that the physical environment should be the first point of attack. Conceivably, the expense of some forms of engineering revision may defeat immediate action, but where an obvious physical danger exists, which it is practical to remove, special employee education and supervision should be considered only as temporary measures until necessary guarding or rebuilding can be accomplished.

Guards for protection of machine equipment other than point of operation may be subdivided as follows:

(1) Enclosures, covers and barricades.

(2) Special locations and arrangements of machine.

(3) Machine design.

The American Standard Code for Mechanical Power Transmission Apparatus should be referred to whenever there is a question concerning transmission guards.

THE SAFETY VALVE

(Continued from page 3)

University of Pennsylvania, and at the Mellon Institute. The situation described in Mr. Fletcher's article is typical of the work being encouraged by the Foundation.

JUST TO PROVE that you can never tell where you'll find a hazard which ought to be controlled, we pass on to you the following item from the *Chicago Tribune* of a few days ago:

"Omaha, Neb.,—John Gasper sought $5,000 damages from Hans Glissman, golf course operator, for injuries suffered when Gasper stepped into a gopher hole just after making an approach shot. To Gasper's assertion that the course should have been kept reasonably free from such hazards, Judge Charles Leslie ruled today that a golf course was a place where hazards were supposed to be. The suit was dismissed."

Protectors in Standard Safety Code

(Continued from page 4)

The apparatus shall be sufficiently free from mechanical obstructions in order that the wearer may breathe freely at all times.

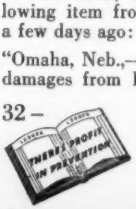
Construction—The apparatus shall be of a design using a mouth-breathing device or other face attachments. The apparatus shall not weigh more than 40 lb. (18 kg.) complete with headpiece and fully charged.

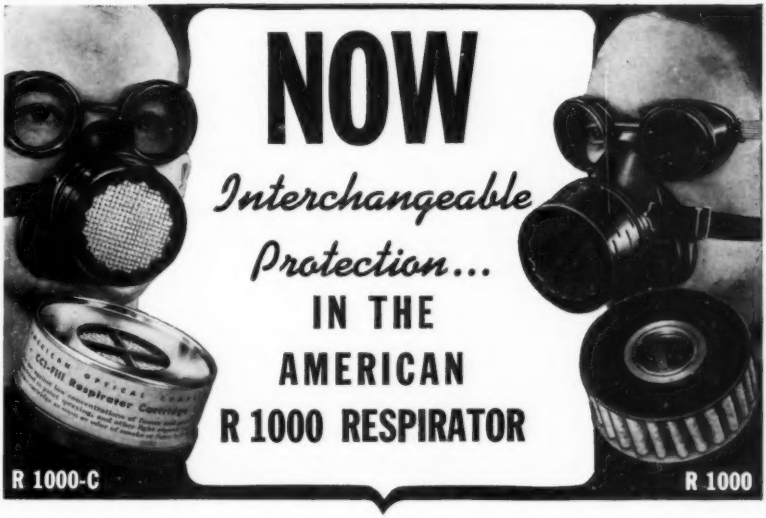
The mechanical construction of the apparatus shall be such that every part can be tested, inspected, and repaired by persons skilled in such work, and all parts which require sterilizing shall be readily accessible for this purpose.

All parts of the apparatus subject to or liable to be subjected to internal pressures in excess of 5 lb. per sq. in. (0.35 kg. per sq. cm.) shall be of such construction or equipped with such safety devices as shall insure the safety of the wearer.

In apparatus equipped with breathing bag or bags, or their equivalent, the inhalation and exhalation compartments shall have a combined capacity of at least 488 cu. in. (8 litres). If a single breathing bag is used it shall have a capacity of at least 305 cu. in. (5 litres).

When the breathing bag is used in conjunction with the operation of the oxygen admission valve the bag shall have a capacity for at least 183 cu. in. (3 litres) of air above the closing-off point of the admission valve, and after 3 litres of air is introduced in the bag, the water-gage pressure shall not exceed 3 in. (7.6 cm.).





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CC-2 Fill . . . For use against low concentrations of acid gases.

CC-3 Fill . . . For use against low concentrations of acid organic gases.

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